

PhET Simulations: Reaction Rates

- 1) Go to the following website:

<http://phet.colorado.edu/en/simulation/reactions-and-rates>

- 2) Click the green button that says “Run Now.” This should open the Java Simulation.
- 3) On the right side of the simulation click the “+” signs next to “separation view” and “energy view.”
- 4) Look at the energy level diagram shown. Is this reaction endothermic or exothermic?

- 5) Pull the red knob on the simulation to launch the shooter. Watch the particles move around in the box. Record 2 observations about their velocities.

1. _____

2. _____

- 6) Watch the collisions occurring between the particles. Record three observations about the collisions.

1. _____

2. _____

3. _____

- 7) Raise the temperature of the particles. What do you notice about their velocities?

- 8) Contrast the collisions of the warmer particles with the earlier, colder ones.
Record two differences between the two scenarios.

1. _____

2. _____

- 9) Click “Reset All” on the right side of the screen.

Chemical Reaction 1

- 10) Click on the blue top tab that says, “Rate Experiments.”
- 11) At the bottom right corner check the boxes next to “Bar” and “Show Stopwatch.”
- 12) In the middle of the right side, slide the initial temperature gauge and watch the green line on the enthalpy level diagram move. Move the green line up until it is at the top of the words “Potential Energy.”
- 13) In the upper right corner find “Start With How Many.” Type “10” next to “A” and “10” next to “BC.”
- 14) Click “Begin Experiment” and then quickly start the timer.
- 15) Watch the bar graph. When 4 particles of AB have formed stop the timer.
Record the time here. Don’t worry about the units.

- 16) Click “End Experiment” and Reset the timer.

Chemical Reaction 2

- 17) Slide the initial temperature gauge and watch the green line on the enthalpy level diagram move. Move the green line up until it is at the peak of the blue curve.
- 18) Click “Begin Experiment” and then quickly start the timer.

- 19) Watch the bar graph. When 4 particles of AB have formed stop the timer.
Record the time here. Don't worry about the units.

- 20) Click "End Experiment" and reset the timer.

- 21) Explain the difference in the time from steps 15 and 19.

Chemical Reaction 3

- 22) Slide the initial temperature gauge and watch the green line on the enthalpy level diagram move. Move the green line down until it is at the top of the words "Potential Energy."

- 23) Change the number of particles of A from 10 to 30.

- 24) Click "Begin Experiment" and then quickly start the timer.

- 25) Watch the bar graph. When 4 particles of AB have formed stop the timer.
Record the time here. Don't worry about the units.

- 26) Click "End Experiment" and reset the timer.

- 27) Explain the difference in the time from steps 15 and 25.

Giving Things a Little More Thought

28) Explain what you think would have happened to the number of particles of A and BC if you had continue to let the simulation run for a long time. Explain why you think this.

A

BC

29) Assuming that all the particles in the box are gases, what happens to the pressure in the box as you add more particles?

30) What would happen to the time required to produce 4 AB particles if you were somehow to stretch the box to make it larger. Why?

31) As you watch the simulation progress you notice that the amount of AB particles fluctuates. Sometimes it goes up and sometimes it goes down. Explain why you think this happens.

Chemical Reaction 4

32) Do an unauthorized experiment. Do whatever you want to the parameters of the simulation. Record what you did. Run it and record what happens.

33) Write down one question you have about reaction rates resulting from your performing these simulations.
